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MEMORANDUM

TO: Dr. Kathy Chaston and Dana Okano, NOAA CRCP; and Rachel Zuercher, CNMI Coastal Resource Management

FROM: Anne Kitchell, Horsley Witten Group

DATE: May 9, 2012

RE: Summary of CNMI Rain Garden Installation Clinic

This memorandum provides a brief summary of the April 25-26, 2012 rain garden installation clinic at the Museum of Culture and History in Garapan, Saipan. The purpose of the clinic was to: 1) construct a demonstration rain garden; 2) develop guidance material and provide basic training for future installations; and 3) identify additional opportunities for rain gardens in Garapan. Horsley Witten Group and the Center for Watershed Protection were the primary trainers during the clinic, however Rachel Zuercher and Ryan Okano (DEQ) both had key instructor roles related to permitting, supply acquisition, and planting. The memo is organized as follows: Site Selection; Clinic Agenda; Rain Garden Design and Installation; Maintenance Recommendations; and Key Observations/Next Steps. Attached are the attendance list, material list, rain garden inventory field sheets from three sites in Garapan, and an evaluation form summary.

A link to an article in the *Marianas Variety* on the installation can be found at: www.mvariety.com/cnmi/cnmi-news/local/45917-not-your-average-garden-party.php.

Site Selection

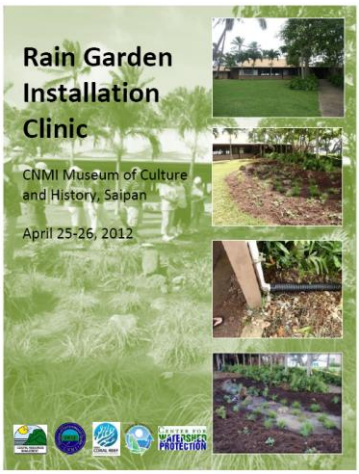
The museum site was selected in advance by Rachel Zuercher (CRM), Dana Okano (NOAA), and Emanuel Borja (DEQ) as a publicly-owned and highly visible demonstration site. A number of locations at the site were considered including the open grassed area/ditch to the right of the museum drive entrance, the landscape island between the drive aisle and Middle Rd., and the grassed area between the building's main entrance and cistern (Figure 1). After much discussion regarding the pros and cons of each location, the landscaped island was selected due to the smaller drainage area, higher perceived visibility, and potential to alleviate standing water issues on the drive aisle (Figure 2). Tree roots, foundation setbacks, and flooding potential limit the feasibility of a rain garden near the building; however, the site in the open area remains a viable installation location.

Figure 1. Three options considered at the CNMI Museum of Culture and History. The star indicates the location selected for the installation clinic.

Potential rain garden options at the hospital and at Garapan Elementary School were also considered. The site selection process and concept design for these alternative sites were discussed in small groups during Day 1 and Day 2 of the clinic.

Figure 2. Rain garden location selected for installation clinic. Note evidence of ponding water and debris accumulation on edge of pavement. An existing ditch starts to the left of the small palm tree that was used as overflow from the rain garden.

Clinic Agenda



The three days in advance of the clinic were spent finalizing the rain garden design, completing major excavation, and collecting and stockpiling materials on site in preparation. The clinic itself spanned two-days. There were 34 participants that signed in (see attached sign in sheet). Each was given a design sketch of the rain garden to be installed, as well as a packet that included an agenda, a brochure outlining how to install a rain garden on CNMI, an example sizing exercise, information on how to test soils, and a field form. An evaluation form and a short quiz were also included in the packet.

Day 1 started with the rain garden construction in the morning, followed by lunch and a classroom session in the afternoon. A tent on-site was provided for the installation, and a nearby church community center was used as an air-conditioned space for lunch and afternoon classroom activities. The room was too bright to show prepared powerpoint presentations; so sessions on rain garden siting, design, installation, and maintenance relied on a white board and the clinic packet. Participants were broken into small groups to practice sizing calculations, which was followed with a short group discussion on installation and maintenance procedures. Participants returned to the museum site at the end of the day in small groups that rotated between three field stations: site selection, infiltration testing, and drainage area determination.

Day 2 began at the American Memorial Park and involved small groups conducting a rain garden inventory at three other sites in Garapan: the hospital, the Garapan elementary school, and the Micro Beach parking lot using the field form. Each group developed a concept for these sites, which are attached to this memo. The groups reconvened at the park and reported out their findings. The hospital and Micro Beach both offer rain garden opportunities. The school site seems less feasible. Alternative stormwater retrofits were identified at the school site by Winzler and Kelly (2010) as part of the Garapan Drainage Improvement Study. Participants then completed a short quiz and clinic evaluation form. Everyone passed the quiz. A summary of evaluation forms is provided below.

Rain Garden Design and Installation

The sizing equation used to estimate the surface area of the rain garden is based on the drainage area, desired ponding depth, which depends primarily on soils, and the target rainfall for CNMI, which is 1.5 inches according to the CNMI Stormwater Design Manual.

$$\text{Rain garden surface area } (ft^2) = \frac{\text{Drainage area } (ft^2 \text{ impervious}) \times \text{CNMI target rainfall depth (ft)}}{\text{Ponding Depth (ft)}}$$

The impervious area draining to the rain garden was estimated to be approximately 2,600 square feet and consists of a portion of the driveway entrance and the drive aisle pavement,

which is pitched towards the grassed island. The soils are heavily-disturbed and compacted fill, with a heavy clay and limestone rock content. We designed for a 6-inch ponding depth with an amended soil media. In this scenario, ideally, we would try to install a 650 square foot rain garden; however, given the uncertainty of material availability, excavator access, and the training environment we felt that a 200-300 square foot rain garden was the largest we could reasonably manage.

An approximately 8-foot wide linear rain garden was designed to fit in the existing grassed area adjacent to the drive aisle. Figure 3 shows the site design sketch. The key design elements included:

- A 1.5 ft-wide rock apron (2" washed coral stone) over a non-woven geotextile that sits 1 inch below the top of the asphalt drive aisle edge. The purpose of the stone apron is to accept stormwater from the pavement area and to distribute inflow evenly and non-erosively into the rain garden. The geotextile prevents the rock from sinking into the native soils and vegetation from blocking flow path.
- The native soils were over-excavated and amended with two truckloads of sand (course dredge sand NOT fine crushed limestone) and 1 truckload of compost to enhance infiltration and plant growth. A 2-inch layer of shredded mulch was spread across the bed and slopes. Boulders and stone accents were added for aesthetic interest during the initial start up period.
- The side slopes were cut back to 3:1 and planted to reduce erosion potential.
- The outlet structure is an earthen berm with overflow spillway set at an elevation below that of the pavement, but 6-inches above the level bed to allow for ponding prior to outflow to an existing ditch down gradient. This ditch starts at the berm, runs the remaining length of the landscaped island, enters a trench culvert below the drive entrance, and then continues through an open grass area (the other potential rain garden site) until it disappears near the property boundary. Overflow from this area drains to a roadside swale and eventually down to Beach Rd. and into the ocean.

CRM coordinated with a number of agencies and local vendors for the installation clinic:

- Division of Environmental Quality (DEQ)—for initial design assistance and to apply for construction permits. DEQ conducted an erosion control inspection of the site to ensure compliance with the permit. DEQ also worked closely with NOAA and CRM to visit the local plant nurseries and identify plant species that would be appropriate for a rain garden installation.
- Commonwealth Utility Company (CUC)--to verify the location of water and other utility lines in the area. It was determined that a historic water line was below the area of interest, which indicated that the area had been previously disturbed and not likely a historic or safety concern.
- Department of Public Works (DPW)—also notified since the area is within/or close to the road right-of-way. DPW donated excavator and operator, as well as water tank and pump for short-term watering of plants.
- Department of Agriculture—supplied vetiver grass
- Forestry Department—supplied Ti trees and mulch

- Museum facilities manager—provided information on drainage patterns and maintenance procedures on site.
- Mayor's Office—across the street for water to fill the water tank as well as access to bathrooms during the installation.
- MINA- for long-term maintenance support

DEQ and CRM staff collected materials needed for the installation including the plants, sand, and mulch. Hawaiian Rock donated stone and filter fabric and delivered materials to the site. Plants were purchased from Wireless Ridge Nursery and Tropical Gardens. Silt fence material was purchased from Hawaiian Rock. Mulch was donated from the Lao Lao golf course/resort and from Forestry. Compost/organic mix was purchased from Ted Topsoil next door to the museum and from ACE Hardware. Tools and supplies (e.g., wheel barrow, line and hand levels, grass seed, spray paint, etc) were purchased at ACE Hardware.

A list of supplies, plants, and unit costs (where available) are attached to this memo. Figure 4 shows a planting plan for the rain garden based on the actual installation.

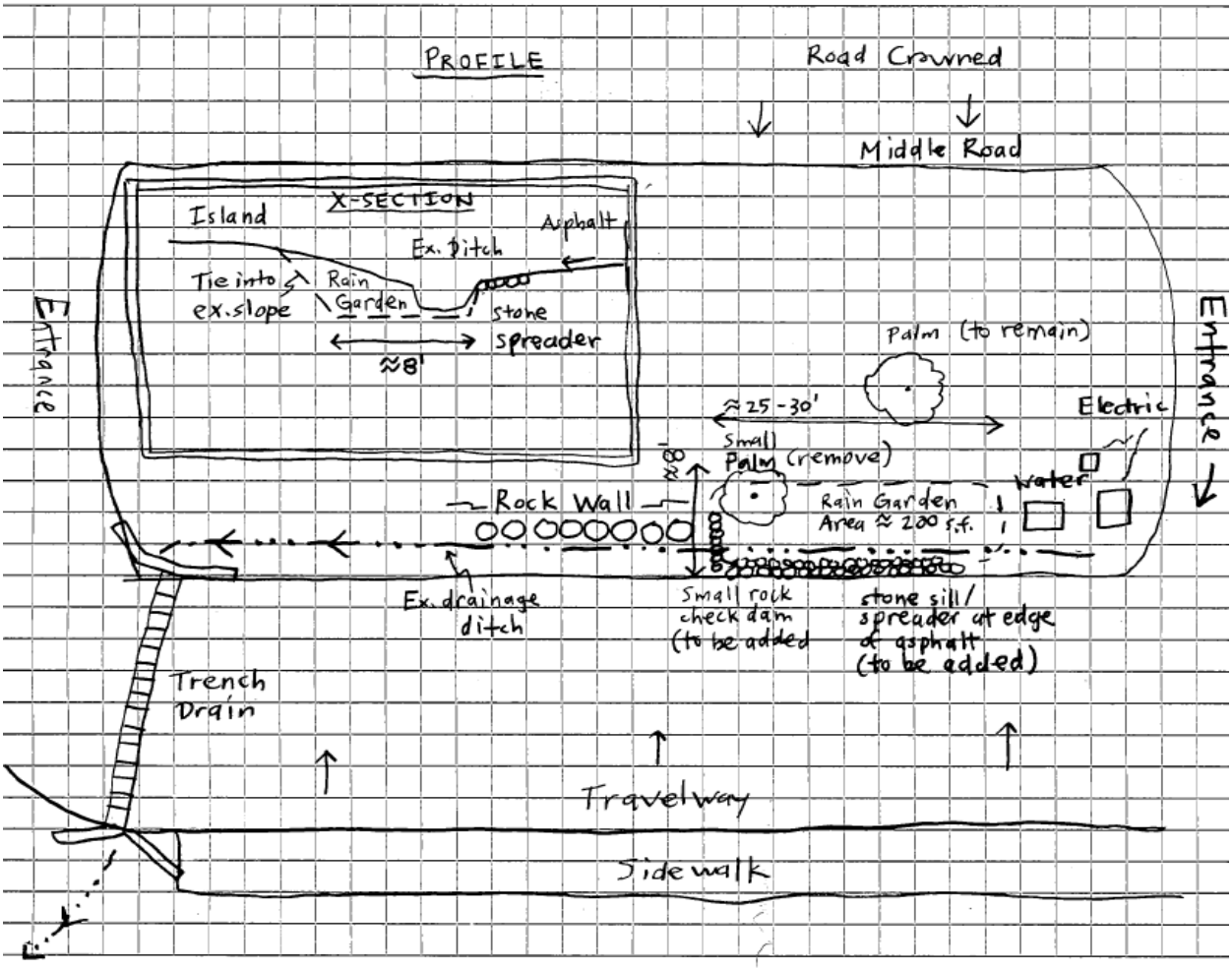


Figure 3. Design sketch for rain garden; plan view and cross section. Note existing utilities, drainage ditch, and trees.

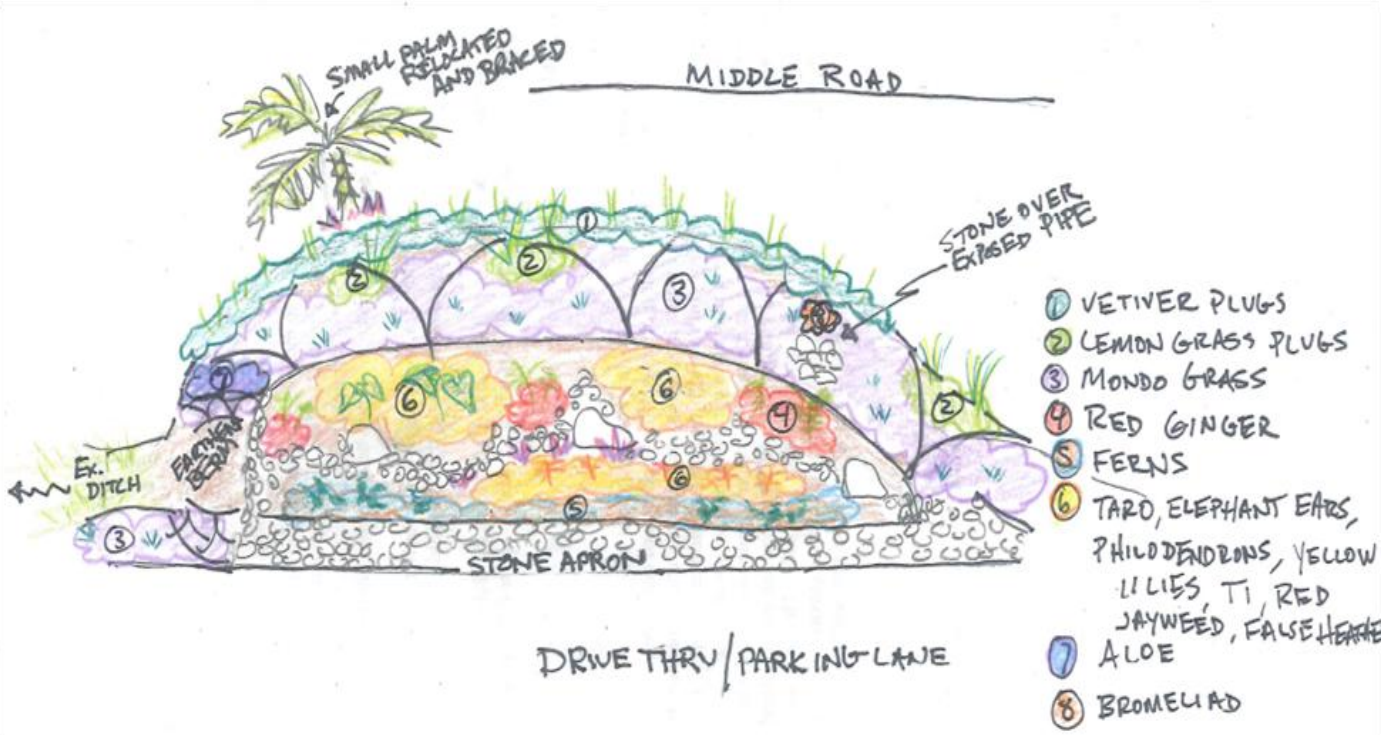


Figure 4. Planting plan for the CNMI Culture and History Museum Rain Garden. Plant selection was a bit of an experiment and was influenced by avialability and expected inundation patterns.

After initial excavation by DPW, the installation process was roughly divided into five phases to help distribute the workload across clinic participants (see Figure 5):

1. Installation of stone apron;
2. Amending of soil media;
3. Installation of the overflow berm;
4. Plant placement and installation (overseen by Ryan Okano); and
5. Mulching (mulch added after initial watering).

Relative elevations were checked with an engineer's survey level to ensure that the height of the rock apron, top of bed, and top of berm/spill way were at the appropriate elevations to result in uniform ponding and positive overflow drainage to the existing down-gradient ditch. Final elevation of the planting bed resulted in a 4-inch ponding depth rather than the 6-inch depth target.

Maintenance Recommendations

A full list of maintenance activities for rain gardens is provided in the clinic packet. In the first few months following installation, more frequent inspections and maintenance effort will be required to support plant establishment. Less intensive care will be required after the first 6 months.

Figure 5. (From top left to bottom right) The site after major excavation the morning of the installation; amending native topsoil with course sand and compost; laying of stone apron; leveling of the overflow berm; placement of plants based on inundation zones; and watering of the final product.

A number of specific items are recommended for this installation in the short-term (first 3-6 months):

1. Identify who is responsible for short vs long-term care. Is this the Museum groundkeeper, MINA, DPW, or DEQ?
2. Once all stockpiled material is removed; mulch or seed disturbed area where topsoil was stored. This area will ultimately drain to the rain garden, so the less sediment transported the better.
3. Daily watering is recommended until the rainy season kicks in or until plants have fully adjusted. Since the water is not working at the Museum, continued assistance from DPW and the Mayor's Office will be paramount. Be sure to water/re-brace the small palm that was relocated during excavation. It wasn't the best replanting job, and the bracing technique is questionable.
4. Keeping weeds out will likely be the biggest challenge, and weeding should be done on a weekly or more frequent basis for the first few months, at a minimum. Given the tenacity of tropical vegetation and the unknown origin of mulch and compost, it would not be surprising for *tangan tangan* to attempt a rain garden overrun.
5. Check to make sure the rock apron and berm armoring remain stable after storm events. If additional rock is needed, pull replacement aggregate from the aesthetic channel in the center of the bed. Be sure to maintain the 1-inch drop from the edge of pavement to the top of the apron. If adding stone to the berm, be sure the elevation remains lower than the rock apron. If small stones are always moving, you may need to mix some larger stones into the apron to help stabilize.
6. During or after the first major rain event, verify that inflow is well distributed across the apron, uniform ponding occurs in the bed, and overflow across berm occurs. Adjustment of the berm height may be needed if backup onto the pavement is occurring or water remains stagnant for more than a few days after the last rainfall. Ponding water could also mean that additional soil amendments or an underdrain may be required. If so, call your engineers at 508.833.6600 to brainstorm the best options for this. One option may be to extend the raingarden the full length of the grassed island and discharge directly into the trench drain under the drive lane.
7. Check for erosion of the berm spillway. If you see erosion, add more native topsoil (clay) and really try to compact it down. You may end up having to embed rock while maintaining the current elevation (you may need to bring survey equipment back out to check).
8. Check on the erosion on the side slope. You may need to add more mulch where erosion is occurring, but also ensure that the vetiver at the top of the slope gets established.
9. Observe the health of plants and be prepared to replace dead plants on an as needed basis, particularly in areas were vegetative density appears low and or in areas where stabilization is critical (slope).
10. Remove trash.

Many of the short-term items also carry over for long-term maintenance; the frequency can be reduced as needed for many of those items (i.e., annually or only after major storm events). Feedback from those conducting inspections and maintenance in the short-term will be needed to establish an effective long-term plan. Consider some of the following:

- Since this is a demonstration site, the aesthetics of the rain garden will be extremely important; therefore, more landscape maintenance will likely be required.
- Watering should not be necessary, except during the dry season if needed.
- Weeding frequency should be reduced and/or replaced by pruning and trimming activities once preferred species have enjoyed two or three full growing seasons.
- Since plant selection was a bit of an experiment, specific attention should be paid to what plants seem to thrive and in which inundation zone. You may consider switching out species with alternatives to improve color, texture, seasonal patterns, or to test inundation tolerance of various species.
- Mulch replacement may need to occur on an annual basis, or more frequently depending on how mulch responds to tropical conditions.
- Stone (and some bed material) may need to be removed/ replaced in order to clean out accumulated sediment. The filter fabric may also need to be replaced or re-stapled.
- Eventually, the growth of plants and the accumulation of mulch and sediment in the planting bed will reduce the available ponding area. This will require a more extensive maintenance effort to re-establish ponding capacity. Perhaps this would be a good opportunity to extend the rain garden further downgradient, or to add an underdrain system, if needed.

Key Observations and Next Steps:

The following observations were made during the course of this project that will likely influence our understanding of how rain garden should be constructed in the Pacific (in no particular order):

- There was a lot of back and forth regarding the recommended method for sizing rain gardens. We opted to use a simple, consistent calculation based on CNMI's target rainfall of 1.5 inches, which represents about 90% of all storms during the year. Using this method, the installation at the museum site is undersized (by about ½), meaning we are not capturing the full 1.5 inches. This should not affect performance, just the ability to manage and treat all rainfall during the small storms. Larger storms are not intended to be managed by the raingarden, regardless. Rain garden sizing differs from bioretention sizing, which accounts for storage/flow through the media.
- This rain garden is on-line, meaning that all the stormwater generated in the drainage area will flow through the practice, even if the practice doesn't manage all that water (e.g., doesn't pond the water for infiltration, evaporation, or plant uptake). It will be interesting to see how the practice holds up during large events.

- There are options available if the rain garden does not function correctly, depending on the diagnosis. Adjusting the elevation of the overflow berm or expanding the size of the facility are probably the simplest measures if standing water is an issue. High evaporation rates may alleviate (or mask) any ponding issues associated with reduced plant uptake or infiltration.
- Digging in Saipan soils would have been extremely difficult, if not impossible, without the use of heavy equipment. In fact, digging holes for infiltration tests was difficult, given the high clay and stone content. Plus, it was the dry season and antecedent moisture conditions were low making soils that much more compact. Having the hole dug in advance was critical to completing the installation within the available training time.
- Most materials were available thanks to significant, advanced coordination by CRM. The hardware stores have limited supplies of bagged compost and mulch. Fortunately, Forestry Department and the golf course were able to supply mulch. Compost from Ken topsoil seems to be a good supply if enough advanced notice can be provided. Sand for soil amendments is available, but it is important to distinguish between course sand (from dredging activities) vs. crushed limestone. The fine limestone "sand" will turn to concrete when wet and is NOT recommended for use in soil amendments. Stone from the quarry should be washed. They can do this, but may require advanced notice. They do have a gravel size available, but it is not washed and the quarry is currently not set up to wash that size of aggregate.
- Plant selection is highly dependent on availability. Many of the species used were propagated in advance specifically for this installation (i.e., lemongrass, ferns, ti) and many were considered experimental given the uncertainty of the inundation regime for this installation. Because we planted during the dry season, having a supply of water on site to help plants get established was critical.
- There is no "dig safe" equivalent in Saipan; however, staff from the CUC came out to the site to verify existing pipe locations. This was partially helpful due to lack of mapping records that distinguish between abandoned vs active utility lines.
- We can't comment enough how critical it was to have on-the-ground coordinators.

Next steps with this rain garden include:

1. Installing interpretive signage. There is potential to link up with signage for the Guam installation. NOAA, CRM, and HW to discuss.
2. Establishing a short and long-term maintenance plan. CRM/MINA/DPW/Museum?
3. Planning to track plant success. DEQ and NOAA?
4. Deciding if any of the sites identified during the field inventory on Day 2 are worth pursuing. The hospital has shown an interest. NOAA?
5. Consider producing a rain garden brochure that can be distributed by DEQ or CRM. DEQ?

Rain Garden Installation Workshop
Sign-In Sheet

	Name	Agency/Organization	Email
1.	Dana Okano	NOAA CRCP	dana.okano@noaa.gov
2.	Carlos Camacho	Tapochau Farm	daniel c lamar c gmail.com
3.	Reyes, Julius	NMC/ENRO	juliusreyes670@gmail.com
4.	Jay Doronila	USDA - NRCS	jay.doronila@pb.usda.gov
5.	Angie Villagomez		cv.angie@gmail.com
6.	Ken Baer	Retired	kbaer30@gmail.com
7.	Andre Kozij	APASEEM	akaspn@hotmail.com
8.	Francisco Villagomez	MINA	fcvillagomez@gmail.com
9.	Peter T. Olopai	DLNR Parks+Rec	—
10.	Aric Bickel	DEQ	aricbickel@deq.gov.mp
11.	Okano, Ryan	DEQ	ryanokano@deq.gov.mp
12.	Jose Quan	DEQ	josequan@deq.gov.mp
13.	Steven Johnson	DEQ	stevenjohnson@deq.gov.mp
14.	Rachel Zuercher	CRM	rachel.zuercher@gmail.com
15.	ANTHONY ROGOLOFOI	PARKS - RECREATION	—
16.	Angel Palacios	DEQ	angelpalacios@deq.gov.mp
17.	Jihan Buniag	DEQ	jihanbuniag@gmail.com
18.	Olivia G.A. Tolmtob	DEQ	oliviatolmtob@deq.gov.mp
19.	Steve McKagan	NUAA	STEVEN.MCKAGAN@NOAA.GOV
20.	Karen Benson	—	karenbenson.spn@gmail.com
21.	Kaitlin Mattos	DEQ	kaitlinmattos@deq.gov.mp
22.	Tim Quan	DPW - HIGHWAYS	~~tim.tq~~ tq.dpwtsd@gmail.com
23.	WAYNE SANCHEZ	M.O.S.	—

Rain Garden Installation Workshop
Sign-In Sheet

	Name	Agency/Organization	Email
24.	LEONARD BABAUTA	M.O.S.	
25.	James W. Babauta	Forestry	
26.	Jan Castro	DEQ	jancastro@deq.gov.mp
27.	Kapilao Patricio	Parks & Rec.	
28.	Ray B. Matanane	Park & Rec	
29.	Becky Skeele	CRM	rebecca.skeele@crm.gov.mp
30.	JUNAT	CRUSKET@DEQ.GOV.MP ~~DEQ~~	
31.	Daniel Lamar	CHCC	daniellamar@gmail.com
32.	Sonya Dancoe	DPW FH	Spd.dpwtsd@gmail.com
33.	Sam Sablan	MINA	sablansam@gmail.com
34.	John Iguel	DEQ	johniguel@deq.gov.mp
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Unit costs and plant list for CNMI Historic and Cultural Museum Rain Garden Installation April 25, 2012

Item	Quantity Used	Cost	Source
Silt fence	50 ft	$62.00	Hawaiian Rock (75 ft roll)
Tarps	3	$50.00	ACE Hardware
Grass seed (stabilization of dis	small bag	$7.50	ACE Hardware
Non-woven geotextile	~75 sq ft	Donated	Hawaiian Rock ($0.25/sq ft)
1.5"-2" washed aggregate	~1/2 cu yd	Donated	Hawaiian Rock ($25/ton)
3"-4" aggregate	~1/2 cu yd	Donated	Hawaiian Rock ($25/ton)
Boulders	3	Donated	Hawaiian Rock
Sand	~2 cu yd	Donated	Dredge pile
Compost	~1 cu yd	$110	ACE Hardware (~$10/samll bag) and Ken Topsoil ($40/8 large bags)
Mulch	~1 cu yd	Donated	Lao Lao Resort and Forestry
Plants	see list below	$350	Wireless Ridge Nursery and Tropical Garden with donations from Forestry, Ag, and CRM
Levels, tapes, string, etc	1	$50	ACE Hardware
shovels, rakes, etc	-	Donated	Coastal Resource Management (CRM)
Equipment/Operator	1 full day	Donated	Public Works
Volunteers	34	priceless	

Plant List

Vetiver (2 large clumps-divided)
Taro (5+)
Elephant Ear (5)
Ferns (5)
Philodendron (5)
Red Jayweed (5)
False Heather (10)
Mondo Grass (107)
Red Ginger (10)
Yellow Lillies (2)
Lemongrass (~8)
Aloe (4)
Ti (10)
Ferns -laau (9)
Bromeliad (1)
Grass seed (small bag)

HAW'N ROCK PRODUCTS SAIPAN

2008 PRICE LIST FOR QUARRY PRODUCTS

PRICES EFFECTIVE NOVEMBER 12, 2008

PRODUCT	UNIT WEIGHT (LBS/CF) ASTM C129	UNIT WEIGHT (TON/CY)	PRICE FOB OBYAN QUARRY	CASH DISCOUNT PRICE	UNIT	DELIVERED PRICE											
						1		2		3		4		5		6	
						DISCOUNT PRICE	LIST PRICE	DISCOUNT PRICE	LIST PRICE	DISCOUNT PRICE	LIST PRICE	DISCOUNT PRICE	LIST PRICE	DISCOUNT PRICE	LIST PRICE	DISCOUNT PRICE	LIST PRICE
WASHED SAND AND AGGREGATE																	
GOLF COURSE SAND	90.00	1.23	$38.37	$34.53	TON	$36.64	$40.48	$37.16	$41.00	$37.69	$41.53	$38.22	$42.06	$38.75	$42.59	$39.27	$43.11
WASHED 3/4" TO 2-1/2" LEACHING FIELD	77.27	1.04	$25.38	$22.84	TON	$24.95	$27.49	$25.47	$28.01	$26.00	$28.54	$26.53	$29.07	$27.06	$29.60	$27.58	$30.12
UNWASHED SAND AND AGGREGATE																	
UNWASHED 3/8" TO 3/4" AGGREGATE	77.46	1.05	$15.88	$14.29	TON	$16.40	$17.99	$16.92	$18.51	$17.45	$19.04	$17.98	$19.57	$18.51	$20.10	$19.03	$20.62
UNWASHED 1/4" TO 3/8" AGGREGATE	80.87	1.09	$15.59	$14.03	TON	$16.14	$17.70	$16.66	$18.22	$17.19	$18.75	$17.72	$19.28	$18.25	$19.81	$18.77	$20.33
UNWASHED SAND	94.53	1.28	$20.41	$18.37	TON	$20.48	$22.52	$21.00	$23.04	$21.53	$23.57	$22.06	$24.10	$22.59	$24.63	$23.11	$25.15
PLASTER SAND	95.55	1.29	$37.00	$33.30	TON	$35.41	$39.11	$35.93	$39.63	$36.46	$40.16	$36.99	$40.69	$37.52	$41.22	$38.04	$41.74
OTHER PRODUCTS:																	
PIT RUN CORAL	93.07	1.26	$14.44	$13.00	TON	$15.11	$16.55	$15.63	$17.07	$16.16	$17.60	$16.69	$18.13	$17.22	$18.66	$17.74	$19.18
2" MAX CRUSHED BASE COURSE	96.07	1.30	$13.13	$11.82	TON	$13.93	$15.24	$14.45	$15.76	$14.98	$16.29	$15.51	$16.82	$16.04	$17.35	$16.56	$17.87
4" MAX SUBBASE	75.33	1.02	$27.67	$24.90	TON	$27.01	$29.78	$27.53	$30.30	$28.06	$30.83	$28.59	$31.36	$29.12	$31.89	$29.64	$32.41
SCREENED TOPSOIL						$32.00		$40.00		$47.00		$55.00		$63.00		$71.00	
ADD (PER LOAD) MINIMUM DELIVERY CHARGE FOR LESS THAN 10 TONS						NOT AVAILABLE											
						AIRPORT AS LITO DANDAN KOBLERVILLE NMCC		CHALAN KANOA CHALAN KIYA CHALAN PIAO OLEAI SANJOSE SAN VICENTE SAN ANTONIO SUSUPE		GARAPAN GUALO RAI PAPAGO		KAGMAN LOWER BASE NAVY HILL PUERTO RICO TANAPAG		AS MATUIS CAPITOL HILL SAN ROQUE LOURDES / AS TEO		MARPI MT. TAPOCHAU TALOFOFO WIRELESS RIDGE	

TENCATE
Mirafi

Drainage

Mirafi® 140NC

Mirafi® 140NC is a nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi® 140NC is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D 4632	kN (lbs)	0.45 (100)	0.45 (100)
Grab Tensile Elongation	ASTM D 4632	%	60	60
Toughness	Grab Tensile Strength x Elongation	lbs	6000	
Trapezoid Tear Strength	ASTM D 4533	kN (lbs)	0.20 (45)	0.20 (45)
Mullen Burst Strength	ASTM D 3786	kPa (psi)	1447 (210)	
Puncture Strength[1]	ASTM D 4833	kN (lbs)	0.29 (65)	
CBR Puncture Strength	ASTM D 6241	kN (lbs)	1.12 (250)	
Apparent Opening Size (AOS)	ASTM D 4751	mm (U.S. Sieve)	0.212 (70)	
Permittivity	ASTM D 4491	sec^{-1}	1.8	
Flow Rate	ASTM D 4491	$l/min/m^2$ ($gal/min/ft^2$)	5704 (140)	
Mass / Unit Area	ASTM D 5261	g/m^2 (oz/yd^2)	136 (4.0)	
UV Resistance (at 500 hours)	ASTM D 4355	% strength retained	70	

[1] ASTM D 4833 has been replaced with ASTM D 6241

Physical Properties	Test Method	Unit	Typical Value	
Thickness	ASTM D 5199	mm (mils)	0.99 (39)	
Roll Dimensions (width x length)	--	m (ft)	3.8 x 110 (12.5 x 360)	4.5 x 110 (15 x 360)
Roll Area	--	m^2 (yd^2)	418 (500)	502 (600)
Estimated Roll Weight	--	kg (lb)	69 (152)	83 (182)

Geofabric 12½' x 30' - 625

$131.95

TENCATE
materials that make a difference

FGS000388
ETQR19

Silt fence @ $ 62.00/roll

.57

WIRELESS RIDGE LANDSCAPING

NURSERY PRICE LISTS

Plant Name	Size	Price
Ground Cover		
Begonia (Hanging)	pcs	$ 5.00
Blue Dase	1gal	$ 1.50
Copeya	1gal	$ 1.50
Firecracker	1 gal	$ 5.00
Fishtail Fern	2 gal	$ 15.00
Ground Orchids	4"	$ 1.50
Ground Orchids	1 gal	$ 5.00
Leriope	1 gal	$ 5.00
Mondo Grass	4"	$ 1.50
Mondo Grass	1 gal	$ 1.50
Shrubs		
Alamanda	1 gal	$ 7.00
Bougainvillea	2 gal	$ 15.00
Bougainvillea	1.5 gal	$ 12.00
Bougainvillea	1 gal	$ 7.00
Bougainvillea	4"	$ 3.00
Cariza	10 gal	$ 45.00
Chinese Bamboo	3 gal	$ 15.00
Chinese Bamboo	1 gal	$ 7.00
Croton	7 gal	$ 25.00
Croton	2 gal	$ 15.00
Dessert Rose	1 gal	$ 8.00
Dracena Margenata	7 gal	$ 25.00
Dracena Multicolor	2 gal	$ 15.00
Elephant Ear	1 gal	$ 7.00
Exora Dwarf	7 gal	$ 25.00
Exora Dwarf	2 gal	$ 15.00
Exora Dwarf	1 gal	$ 7.00
Exora Dwarf	4"	$ 3.50
Five Finger	10 gal	$ 45.00
Fortune Plant	7 gal	$ 25.00
Fortune Plant	2 gal	$ 15.00
Fortune Plant	1 gal	$ 10.00
Golden Duranta	1 gal	$ 5.00
Heleconia	2 gal	$ 15.00
Hibiscus	3 gal	$ 25.00
Hibiscus	1.5 gal	$ 7.00
Hibiscus	1 gal	$ 7.00
Roses	1 gal	$ 5.00
Roses	2 gal	$ 12.00
Roses	10 gal	$ 35.00
Sampaguita	10 gal	$ 35.00
Sampaguita	1 gal	$ 7.00
Song of India	10 gal	$ 75.00
Song of India	5 gal	$ 25.00
Song of India	3 gal	$ 15.00
Song of India	1 gal	$ 10.00
Song of Jamaica	3 gal	$ 15.00
Spottyphylum	3 gal	$ 25.00
Spottyphylum	2 gal	$ 15.00
Spottyphylum	1 gal	$ 10.00

WIRELESS RIDGE LANDSCAPING

NURSERY PRICE LISTS

Plant Name	Size	Price
Spottyphylum	1.5 gal	$ 15.00
Spottyphylum	10 gal	$ 25.00
Texas Ranger	10 gal	$ 45.00
Ti Plant	2 gal	$ 15.00
Ti Plant	1 gal	$ 12.00
Varrigated Hibiscus	1 gal	$ 7.00
Zebra	2 gal	$ 10.00
Orchids		
Cattleya	4" clay pot	$ 20.00
Dendrovium	wood pot	$ 15.00
Local Vanda Orchid Wood Post		$ 10.00
Local Vanda Orchids	Hanging	$ 15.00
MKRA-ASCDA	2 gal	$ 20.00
Purple Lily Hibrid		
Song of Manila	2 gals	
Songomhay Orchids	wood pot	$ 2.50
Songomhay Orchids 8" Clay Pot	pcs	$ 15.00
Field Stock		
Avocado		
Betelnut Palm		
Bird of Paradise (white) 20gals	Strelitzia Nicolai	$ 150.00
Bird of Paradise (Yellow)	Strelitzia Regiane	
Bismarkia		
Bleeding Heart		
Bottle Palm		
Calamansi		
Croton		
Dona Aurora-Pink	10 gal	$ 60.00
Dona Aurora-White	10 gal	$ 60.00
Dwarf Snowbush	10 gal	$ 15.00
Dwarf Snowbush	3 gal	$ 12.00
Ficos Benjamina		
Flametree		
Foxtail		
Giant Heliconia - Parrot (Field Stock)		
Giant Heliconia - Red (Field Stock)	FS	
Giant Heliconia - Yellow (Field Stock)	FS	
Ginger plant	pc.	$ 5.00
Ginger Red	pc	$ 5.00
Golden Shower	FS	
Guyabano		
Ilang-Ilang		
Indian Tree	FS	
Jackfruit		
Lemon Tree		
Macopa		
Mango		
Manila Palm		
McArthur Palm		
Oil Palm		$ 45.00
Pacifico Palm		
Pandanos		

Plant Name	Size	Price
Plumbago	7 gal	$ 35.00
Plumeria		
Rainbow Shower	FS	
Royal Palm		
Sakura tree	FS	
Santol		
Star Apple	FS	
Tamarind		
Varrigated Irantimum	2 gal	$ 10.00
Palm		
Chamaedonea	2 gals	$ 45.00
Chamaedonea	3 gals	$ 35.00
Clustering Palm	2 gals	$ 45.00
Cycas Palm	3 gals	$ 15.00
Cycas Palm	1 gal	$ 10.00
Licuala Espinosa	7 gals	$ 60.00
Livistona Australis	7 gals	$ 45.00
Pinanga Maculata(tiger palm)	2 gals	$ 35.00
Pinanga Maculata(tiger palm)	7 gals	$ 35.00
Pinanga Minahassai	3 gals	$ 65.00
Pritchardia Palm (Field Stock)		$ 60.00
Traveller Palm	10 gals	$ 60.00
Traveller Palm	FS	$ 40.00
Traveller Palm		$ 20.00
Yeitchia Joannis	10 gals	$ 45.00
Palm Tree		
Ariica Palm	7 gal	$ 60.00
Ariica Palm	1 gal	$ 25.00
Bottle Palm	10 gal	$ 75.00
Bottle Palm	2 gal	$ 12.00
Bottle Palm	3 gal	$ 15.00
Bottle Palm	5 gal	$ 35.00
Fishtail Palm	1 gal	$ 10.00
Fishtail Palm	10 gal	$ 45.00
Foxtail Palm	1 gal	$ 35.00
Foxtail Palm	1.5 gal	$ 35.00
Foxtail Palm	10 gal	$ 75.00
Foxtail Palm	3 feet	$ 60.00
Foxtail Palm	5 feet	$ 75.00
Foxtail Palm	7 feet	$ 150.00
Foxtail Palm	7 gal	$ 45.00
Heliconia Giant	per stick	$ 5.00
King Palm	10gal	$ 75.00
Manila Palm	10 gal	$ 35.00
Manila Palm	4 gal	$ 20.00
Manila Palm	1 gal	$ 15.00
McArthur Palm	10gal	$ 35.00
Pan Palm	10 gal	$ 50.00
Panama Hat Plant	3 gal	$ 25.00
Phoenix Roebelenii	10 gal	$ 50.00
Pinanga Geonomaefonmis	3 gal	$ 20.00
Ptychosperma Macanthurii(McArthur palm)	7gal	$ 60.00

Plant Name	Size	Price
Queen Palm	10 gal	$ 75.00
Queen Palm	7 gal	$ 50.00
Raphes	3gal	$ 25.00
Red Palm	7 gal	$ 75.00
Rhapis Humilis	3 gal	$ 45.00
Rhapis Humilis	5 gal	$ 45.00
Rhapis Humilis	1 gal	$ 12.00
Royal Palm	10 gal	$ 80.00
Royal Palm	7 gal	$ 35.00
Royal Palm	3 gal	$ 30.00
Royal Palm	1 gal	$ 15.00
Royal Palm	7 feet	$ 150.00
Royal Palm	15 feet	$ 300.00
Sago Palm	2 gal	$ 15.00
Sealing Wax Palm	10 gal	$ 75.00
Sealing Wax Palm	3 gal	$ 45.00
Touch Palm	10 gal	$ 45.00
Touch Palm	7 gal	$ 25.00
Tufted Fishtail Palm	7 gal	$ 35.00
Tufted Fishtail Palm	25 gal	$ 60.00
Young Palm	10 gal	$ 45.00
Zamia Pumila	10 gal	$ 45.00
Trees		
Avocado	3 gal	
Carrot Wood Tree	10 gal	$ 75.00
Carrot Wood Tree	FS	
Chinese Acacia	2 gal	$ 15.00
Chinese Acacia	FS	
Coral Tree	10 gal	$ 50.00
Flame Tree	10 gal	$ 75.00
Flame Tree	7 gal	$ 45.00
Fruit Trees		
Gardenia	7 gal	$ 25.00
Gardenia	2 gal	$ 12.00
Gold Tree	5 gal	$ 20.00
Golden Shower	1.5 gal	$ 12.00
Ilang-ilang Tree	10 gal	$ 75.00
Ilang-ilang Tree	5 gal	$ 25.00
Ilang-ilang Tree	2 gal	$ 10.00
Ilang-ilang Tree	1 gal	$ 5.00
Indian Tree	5 gal	$ 25.00
Indian Tree	1 gal	$ 7.00
Jack Fruit	3 gal	
Jettropha Husta	10 gal	$ 60.00
Mahogany Tree	10 gal	$ 60.00
Mango	3 gal	
Melandres	10 gal	$ 45.00
Melandres	7 gal	$ 35.00
Melandres	2 gal	$ 25.00
Octopus Tree	10 gal	$ 45.00
Okinawa tree	10 gal	$ 100.00
Orchid Tree (Field Stock)	FS	

WIRELESS RIDGE LANDSCAPING

NURSERY PRICE LISTS

Plant Name	Size	Price
Pinktacoma Tree	10 gal	$ 60.00
Pinktacoma Tree	1 gal	$ 7.00
Plumeria	3 gal	$ 15.00
Plumeria	2 gal	$ 25.00
Sakura Tree	7 gal	$ 45.00
Santol	1 gal	
Star Apple	1 gal	

Rain Garden Investigation **RGI**

DATE: 4/26 & 7/12	WATERSHED: GARAPAN	NAME: Jay Doromal

SITE IDENTIFICATION:

Name/Address: Micro Beach Pavilion Parking Lot

Ownership: ☐ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☒ ~~State~~ FED ☐ DOT ☐ Other: A.M.P

WHAT AREA IS BEING TREATED BY YOUR PROPOSED RAIN GARDEN?

☐ Roof ☒ Parking Lot ☐ Walkway/Patio ☐ Other: _____

HOW BIG IS THE DRAINAGE AREA TO BE TREATED? (MEASURE OR PACE OFF)

Length = 100 feet

Width = 30 feet

Area = 3000 square feet

$$= \frac{3000 \times 0.125}{0.5} = 750 \text{ sq.ft}$$

← 6" dept.

DESCRIBE THE SOIL IN THE AREA PROPOSED FOR THE RAIN GARDEN

☐ Clay ☒ Sand ☐ Loam ☐ Other: Sandy loam.
☐ Compacted ☐ High groundwater (<2 ft)

DESCRIBE THE LOCATION OF YOUR PROPOSED RAIN GARDEN?

Slope: ☒ Area is flat ☒ Area has moderate slope ☐ Area has steep slope

Veg.: ☒ Grassy ☒ Existing trees & shrubs ☐ Existing forest

Visibility: ☒ High visibility area/lots of people will see it ☐ Some visibility ☐ Low visibility/hidden

Cover: ☐ Sunny ☒ Mixed sun & shade ☐ Shady

Utilities: ☐ Likely ☒ Maybe or nearby ☐ unlikely

Inlet: ☒ Already goes there ☐ Some effort ☐ Will require work ☐ not sure

Outlet: ☒ Easy ☐ Hard ☐ Not sure

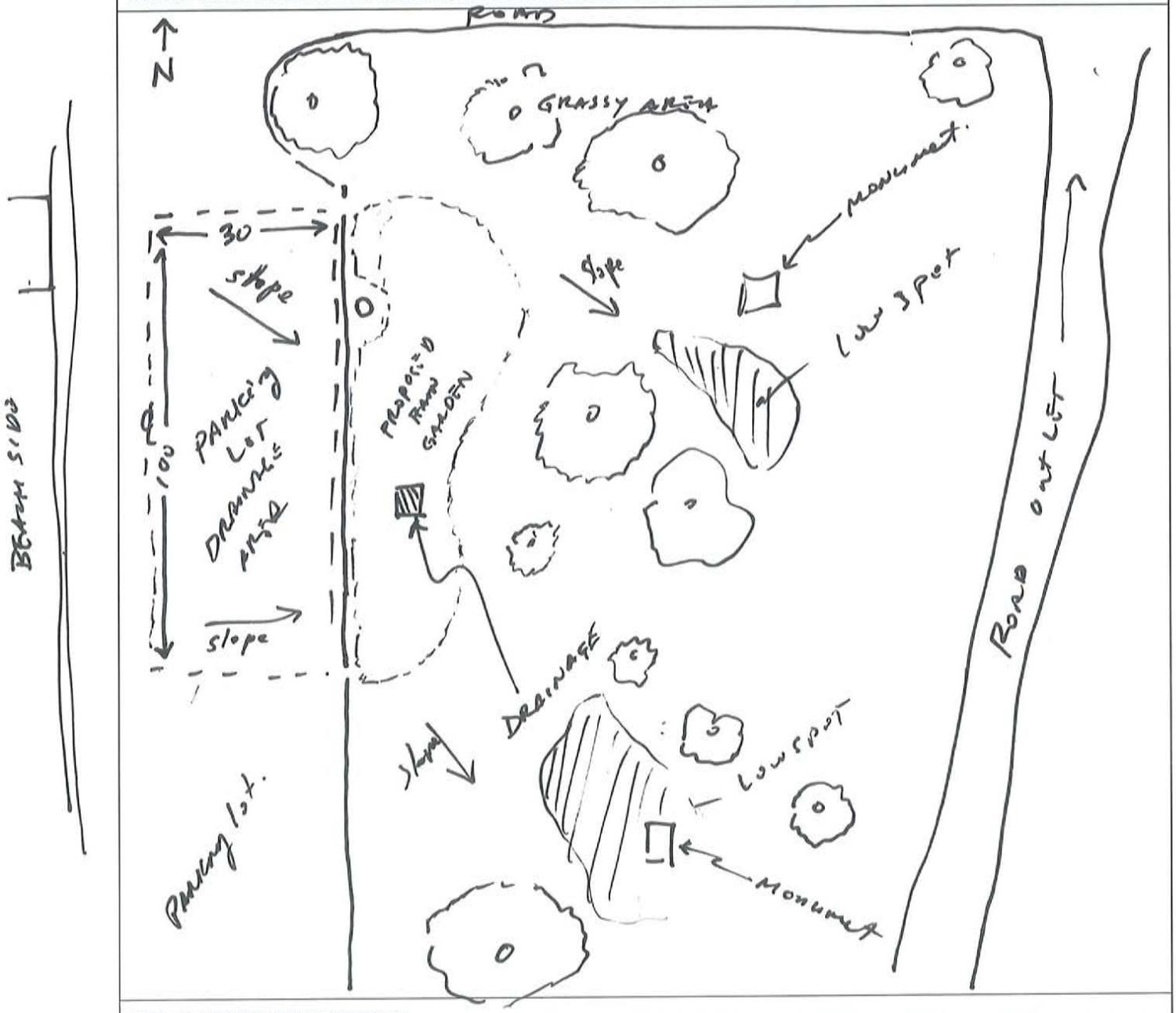
Setbacks: ☒ Met ☐ May be too close ☐ Probably not enough room

Describe features of your proposed rain garden location:

- ocean level, high water table
- confirm existing drainage use? or where does it go to?

Unique Site ID: _____

SKETCH YOUR PROPOSED RAIN GARDEN *(INCLUDE DIMENSIONS OF AVAILABLE SPACE)*



TARGET SURFACE AREA ESTIMATES

Drainage area (impervious) _____ sf **X** CNMI target rainfall **0.125** ft **/** ponding depth _____ ft (e.g.,0.25, 0.50 , 0.67 ft)
= Target rain garden surface area _____ sf

Is space available? ☒ Yes, full ☐ Partial (≥50%) ☐ Partial (<50%)

Unique Site ID:_____

• digital copy

Rain Garden Investigation **RGI**

DATE: 9/27/12	WATERSHED: GARAPAN	NAME: MLW

SITE IDENTIFICATION:

Name/Address: HOSPITAL

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☒ State ☐ DOT ☐ Other:_____

WHAT AREA IS BEING TREATED BY YOUR PROPOSED RAIN GARDEN?

☒ Roof ☒ Parking Lot ☐ Walkway/Patio ☐ Other:_____

HOW BIG IS THE DRAINAGE AREA TO BE TREATED? (MEASURE OR PACE OFF)

Length = 63 feet

Width = 62 feet

Area = 3600 square feet

DESCRIBE THE SOIL IN THE AREA PROPOSED FOR THE RAIN GARDEN

☒ Clay ☐ Sand ☐ Loam ☐ Other:_____
☒ Compacted ☐ High groundwater (<2 ft)

DESCRIBE THE LOCATION OF YOUR PROPOSED RAIN GARDEN?

Slope: ☐ Area is flat ☒ Area has moderate slope ☐ Area has steep slope

Veg.: ☒ Grassy ☒ Existing trees & shrubs (mango tree) ☐ Existing forest

Visibility: ☒ High visibility area/lots of people will see it ☐ Some visibility ☐ Low visibility/hidden

Cover: ☒ Sunny ☐ Mixed sun & shade ☐ Shady

Utilities: ☒ Likely ☐ Maybe or nearby ☐ unlikely

Inlet: ☒ Already goes there ☐ Some effort ☐ Will require work ☐ not sure

Outlet: ☒ Easy ☐ Hard ☐ Not sure

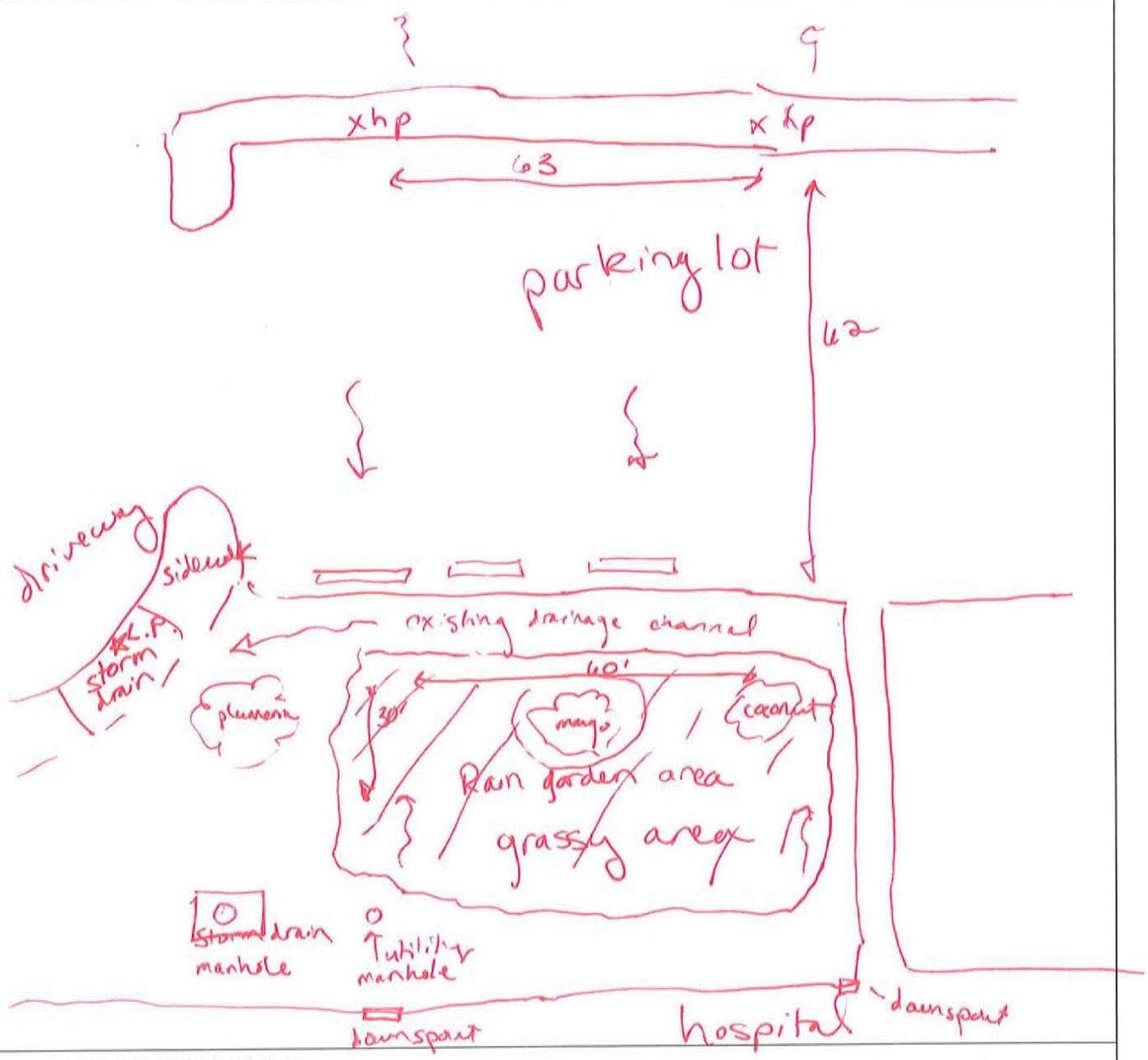
Setbacks: ☒ Met ☐ May be too close ☐ Probably not enough room

Describe features of your proposed rain garden location:

sloped from parking lot, possibly could get roof runoff

Unique Site ID:_____

SKETCH YOUR PROPOSED RAIN GARDEN *(INCLUDE DIMENSIONS OF AVAILABLE SPACE)*



TARGET SURFACE AREA ESTIMATES

Drainage area (impervious) 3600 sf **X** CNMI target rainfall **0.125** ft **/** ponding depth 0.25 ft (e.g.,0.25, 0.50 , 0.67 ft)
= Target rain garden surface area 1900 sf

Space is available, but a lot of excavation required due to existing slope (~3' elevation change). Easy inlet and outlet for rain garden

Is space available? ☒ Yes, full ☐ Partial (≥50%) ☐ Partial (<50%)

Unique Site ID:_____

Rain Garden Investigation **RGI**

DATE: 26 Apr 2012	WATERSHED: U. Takpochau	NAME: KSM

SITE IDENTIFICATION:

Name/Address: Hospital

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☒ State ☐ DOT ☐ Other:_____

WHAT AREA IS BEING TREATED BY YOUR PROPOSED RAIN GARDEN?

☐ Roof ☒ Parking Lot ☐ Walkway/Patio ☐ Other:_____

maybe →

HOW BIG IS THE DRAINAGE AREA TO BE TREATED? (MEASURE OR PACE OFF)

Length = 63 feet

Width = 62 feet

Area = 3900 square feet

DESCRIBE THE SOIL IN THE AREA PROPOSED FOR THE RAIN GARDEN

☒ Clay ☐ Sand ☐ Loam ☒ Other: nasty, rocky
☒ Compacted ☐ High groundwater (<2 ft)

DESCRIBE THE LOCATION OF YOUR PROPOSED RAIN GARDEN?

Slope: ☐ Area is flat ☒ Area has moderate slope ☐ Area has steep slope

Veg.: ☒ Grassy ☒ Existing trees & shrubs ☐ Existing forest

Visibility: ☒ High visibility area/lots of people will see it ☐ Some visibility ☐ Low visibility/hidden

Cover: ☒ Sunny ☐ Mixed sun & shade ☐ Shady

Utilities: ☐ Likely ☒ Maybe or nearby ☐ unlikely probably deep

Inlet: ☒ Already goes there ☐ Some effort ☐ Will require work ☐ not sure

Outlet: ☒ Easy ☐ Hard ☐ Not sure

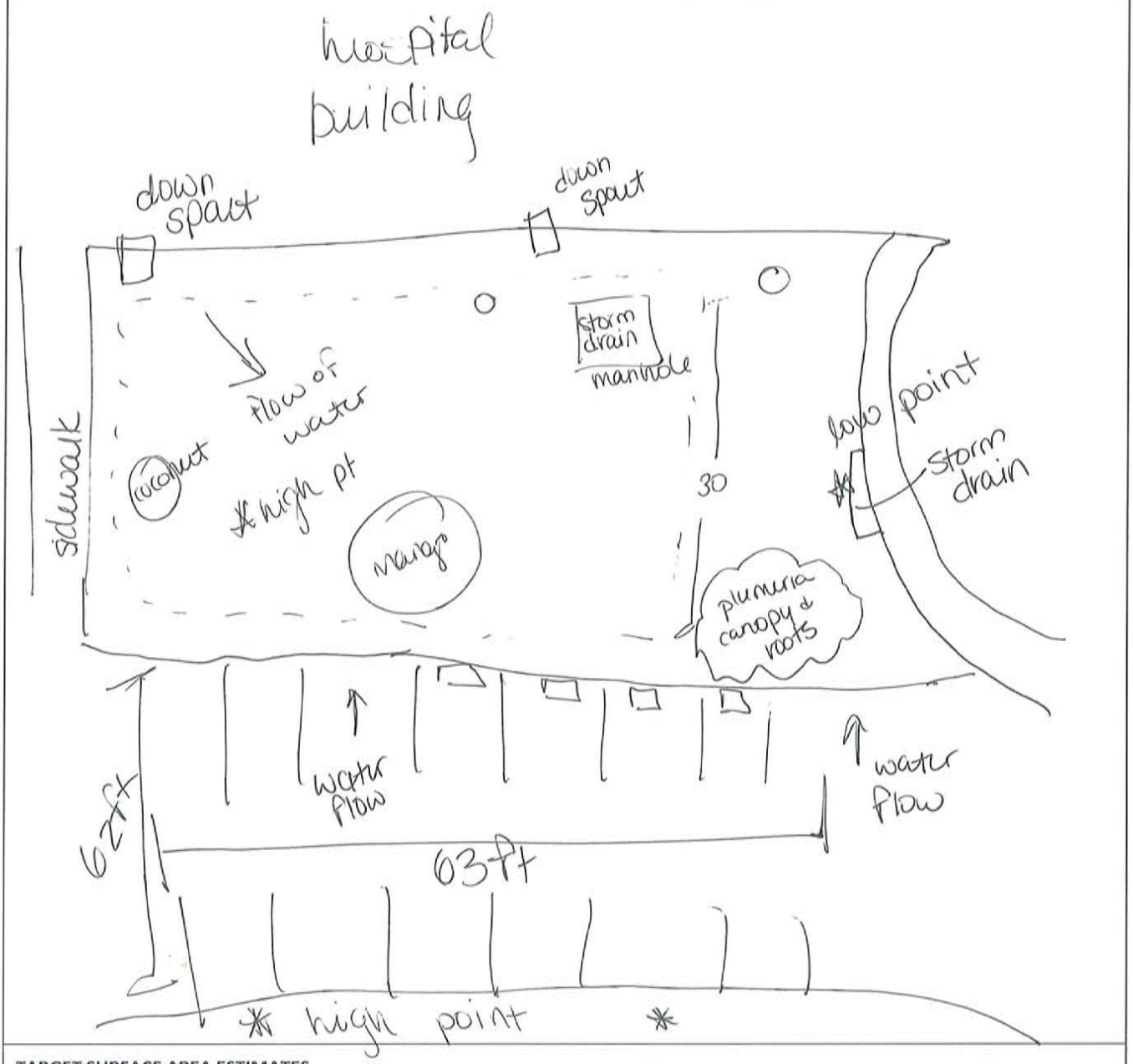
Setbacks: ☒ Met ☐ May be too close ☐ Probably not enough room

Describe features of your proposed rain garden location:

nice slope for inlet & outlet,
1 coconut, 1 mango, - would need to be pruned, 1 plumeria w/ lots of roots

Unique Site ID:_____

SKETCH YOUR PROPOSED RAIN GARDEN *(INCLUDE DIMENSIONS OF AVAILABLE SPACE)*



TARGET SURFACE AREA ESTIMATES

Drainage area (impervious) 3600 sf X CNMI target rainfall **0.125** ft / ponding depth _____ ft (e.g.,0.25, 0.50 , 0.67 ft)
= Target rain garden surface area 1800 sf

blc of existing slope (3ft elev. Δ)
mud to dig a lot, allow trees as islands, easy inlet & outlet

Is space available? ☒ Yes, full ☐ Partial (≥50%) ☐ Partial (<50%)

Unique Site ID:_____

Rain Garden Investigation **RGI**

DATE: 4/27/12	WATERSHED: West Tap.	NAME: Eric Bittel

SITE IDENTIFICATION:

Name/Address: ~~B~~ Hospital (CHC)

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☐ State ☐ DOT ☐ Other:_____

WHAT AREA IS BEING TREATED BY YOUR PROPOSED RAIN GARDEN?

☒ Roof ☒ Parking Lot ☐ Walkway/Patio ☐ Other:_____

HOW BIG IS THE DRAINAGE AREA TO BE TREATED? (MEASURE OR PACE OFF)

Length = _____feet

Width = _____feet

Area = ~~B~~ 1565 square feet + Roof

DESCRIBE THE SOIL IN THE AREA PROPOSED FOR THE RAIN GARDEN

☒ Clay ☐ Sand ☐ Loam ☒ Other:_____
☐ Compacted ☐ High groundwater (<2 ft)

DESCRIBE THE LOCATION OF YOUR PROPOSED RAIN GARDEN?

Slope: ☐ Area is flat ☒ Area has moderate slope ☐ Area has steep slope

Veg.: ☒ Grassy ☒ Existing trees & shrubs ☐ Existing forest

Visibility: ☒ High visibility area/lots of people will see it ☐ Some visibility ☐ Low visibility/hidden

Cover: ☒ Sunny ☐ Mixed sun & shade ☐ Shady

Utilities: ☐ Likely ☒ Maybe or nearby ☐ unlikely

Inlet: ☐ Already goes there ☒ Some effort ☐ Will require work ☐ not sure

Outlet: ☒ Easy ☐ Hard ☐ Not sure

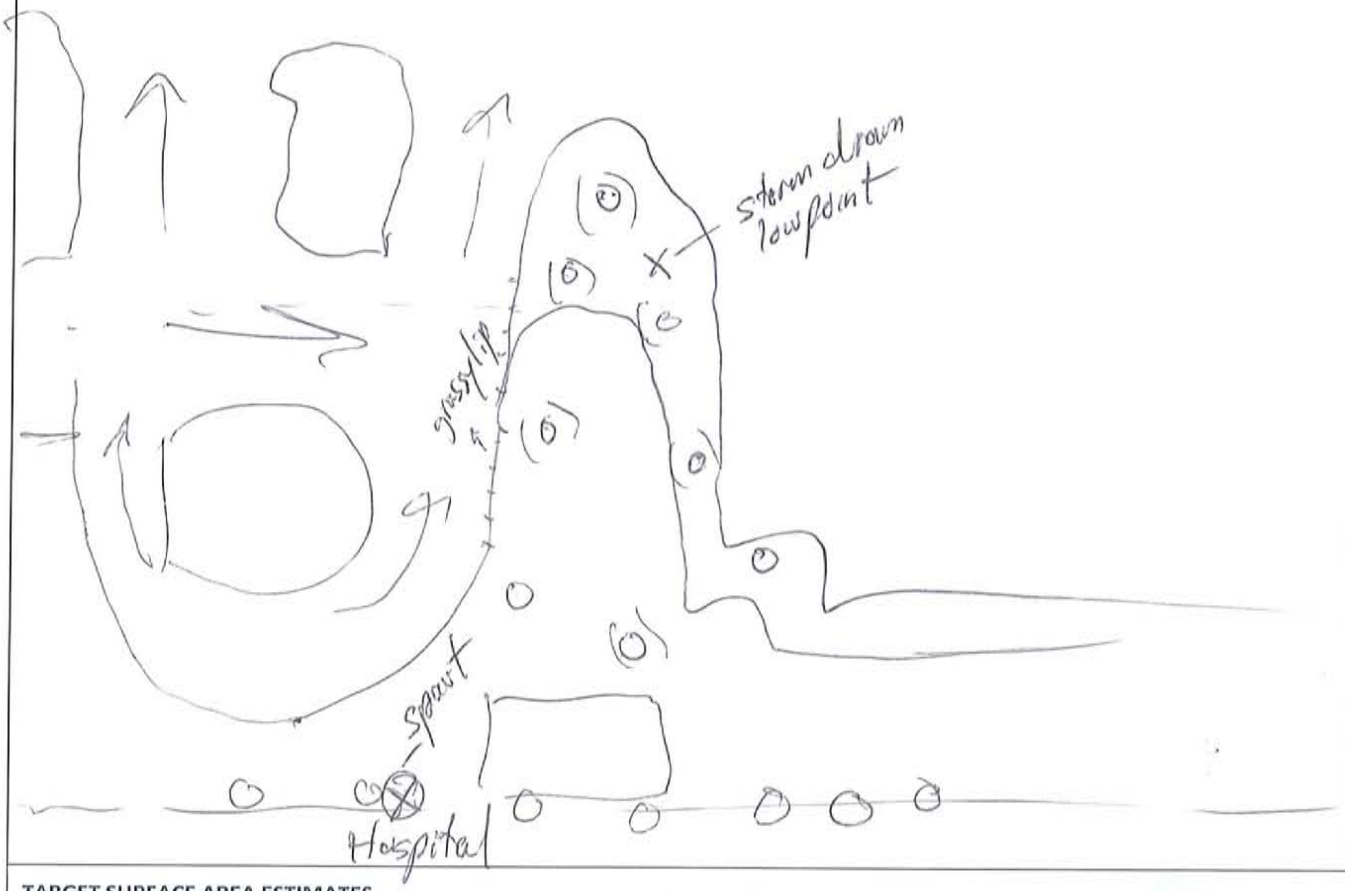
Setbacks: ☒ Met ☐ May be too close ☐ Probably not enough room

Describe features of your proposed rain garden location:

Benches & trees in area; would need inlet help

Unique Site ID:_____

SKETCH YOUR PROPOSED RAIN GARDEN *(INCLUDE DIMENSIONS OF AVAILABLE SPACE)*



TARGET SURFACE AREA ESTIMATES

Drainage area (impervious) 1565 sf **X** CNMI target rainfall **0.125** ft **/** ponding depth .5 ft (e.g.,0.25, 0.50 , 0.67 ft)
= Target rain garden surface area 400 sf (est)

Is space available? ☐ Yes, full ☒ Partial (≥50%) ☐ Partial (<50%)

Unique Site ID:_____

Rain Garden Investigation **RGI**

DATE: 4/26/12	WATERSHED: Garapan Elem.	NAME: Jihan

SITE IDENTIFICATION: Garapan Elem. School

Name/Address:

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☒ State ☐ DOT ☐ Other:_____

WHAT AREA IS BEING TREATED BY YOUR PROPOSED RAIN GARDEN?

☒ Roof ☐ Parking Lot ☐ Walkway/Patio ☐ Other:_____

HOW BIG IS THE DRAINAGE AREA TO BE TREATED? (MEASURE OR PACE OFF)

Length = 150 feet

Width = 22 feet

Area = 3300 square feet

DESCRIBE THE SOIL IN THE AREA PROPOSED FOR THE RAIN GARDEN

☐ Clay ☐ Sand ☐ Loam ☒ Other: Limestone fill
☐ Compacted ☐ High groundwater (<2 ft)

DESCRIBE THE LOCATION OF YOUR PROPOSED RAIN GARDEN?

Slope: ☒ Area is flat ☐ Area has moderate slope ☐ Area has steep slope

Veg.: ☐ Grassy ☐ Existing trees & shrubs ☐ Existing forest ☒ none

Visibility: ☒ High visibility area/lots of people will see it ☐ Some visibility ☐ Low visibility/hidden

Cover: ☒ Sunny ☐ Mixed sun & shade ☐ Shady

Utilities: ☐ Likely ☒ Maybe or nearby ☐ unlikely

Inlet: ☐ Already goes there ☒ Some effort ☐ Will require work ☐ not sure

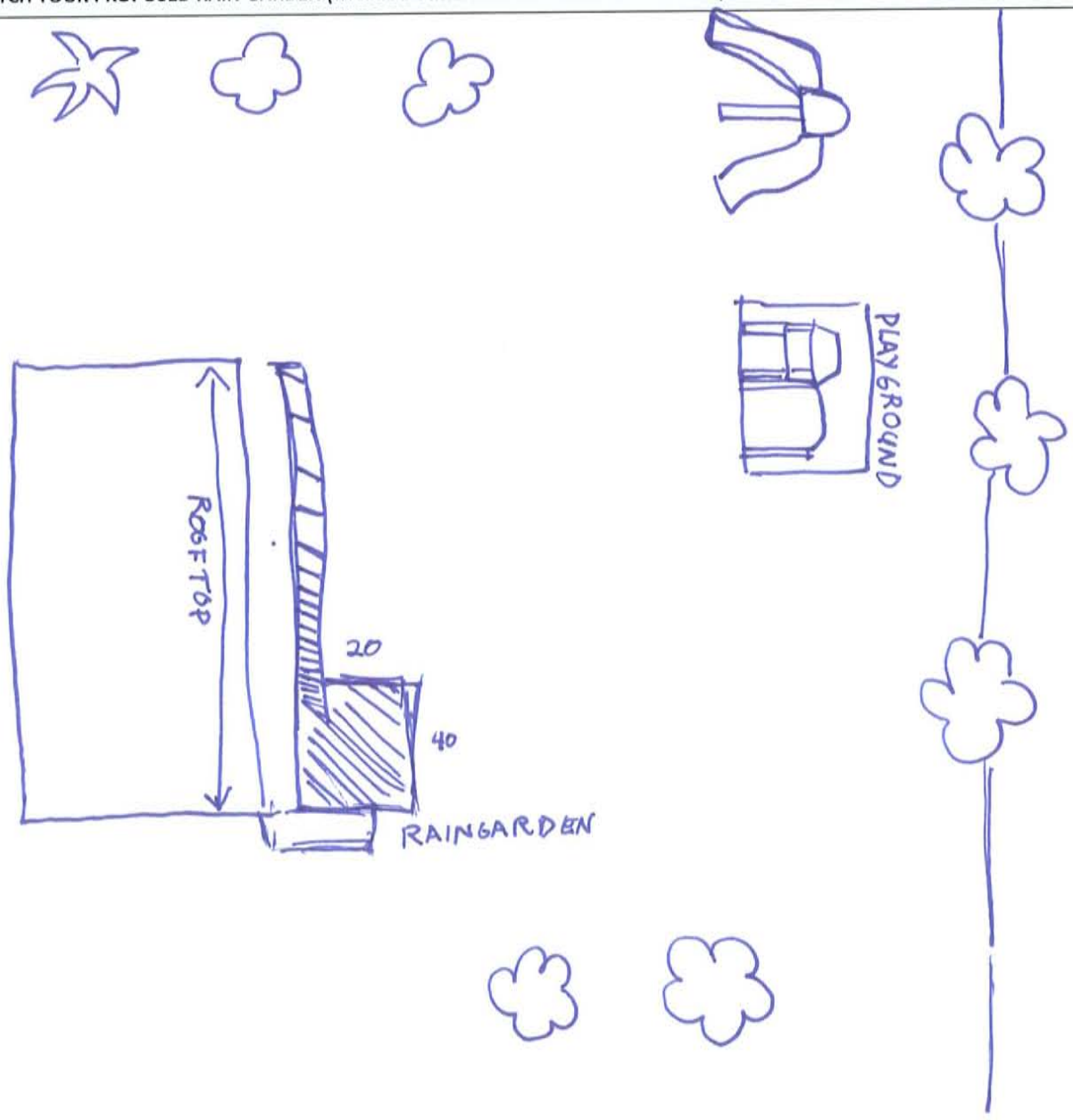
Outlet: ☐ Easy ☐ Hard ☐ Not sure none

Setbacks: ☐ Met ☐ May be too close ☐ Probably not enough room

Describe features of your proposed rain garden location:

Unique Site ID:_____

SKETCH YOUR PROPOSED RAIN GARDEN *(INCLUDE DIMENSIONS OF AVAILABLE SPACE)*



TARGET SURFACE AREA ESTIMATES

Drainage area (impervious) 3300 sf X CNMI target rainfall **0.125** ft / ponding depth .5 ft (e.g.,0.25, 0.50 , 0.67 ft)
= Target rain garden surface area 825 sf

Is space available? ☒ Yes, full ☐ Partial (≥50%) ☐ Partial (<50%)

Unique Site ID:_____

Rain Garden Investigation **RGI**

DATE: 4/26/12	WATERSHED: Garapan	NAME: Steven Johnson

SITE IDENTIFICATION:

Name/Address: Garapan Elementary School

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☒ State ☐ DOT ☐ Other:_____

WHAT AREA IS BEING TREATED BY YOUR PROPOSED RAIN GARDEN?

☒ Roof ☐ Parking Lot ☐ Walkway/Patio ☐ Other:_____

HOW BIG IS THE DRAINAGE AREA TO BE TREATED? (MEASURE OR PACE OFF)

Length = 150 feet

Width = 22 feet

Area = 3300 square feet

DESCRIBE THE SOIL IN THE AREA PROPOSED FOR THE RAIN GARDEN

☐ Clay ☐ Sand ☐ Loam ☒ Other: LS fill
☐ Compacted ☐ High groundwater (<2 ft)

DESCRIBE THE LOCATION OF YOUR PROPOSED RAIN GARDEN?

Slope: ☒ Area is flat ☐ Area has moderate slope ☐ Area has steep slope

Veg.: ☐ Grassy ☐ Existing trees & shrubs ☐ Existing forest ☒ many

Visibility: ☒ High visibility area/lots of people will see it ☐ Some visibility ☐ Low visibility/hidden

Cover: ☒ Sunny ☐ Mixed sun & shade ☐ Shady

Utilities: ☐ Likely ☒ Maybe or nearby ☐ unlikely

Inlet: ☐ Already goes there ☒ Some effort ☐ Will require work ☐ not sure

Outlet: ☐ Easy ☐ Hard ☐ Not sure ☒ Sheet Flow

Setbacks: ☐ Met ☐ May be too close ☐ Probably not enough room

☒ Bamboo trees kids

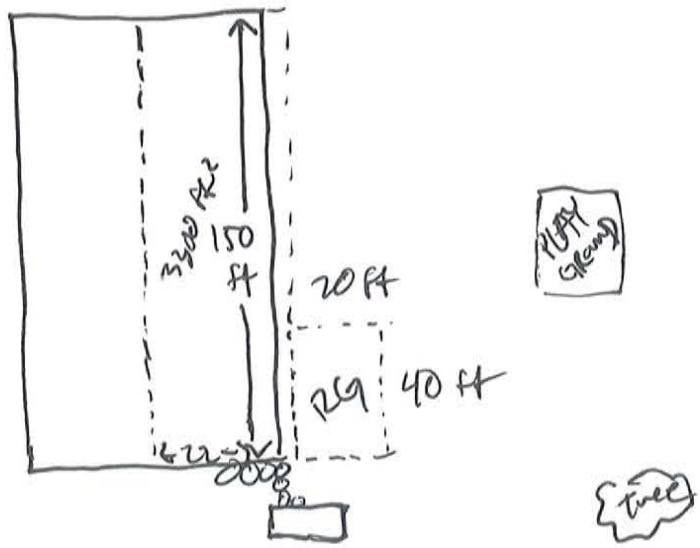
Describe features of your proposed rain garden location:

- Steps Touch @ drip line
- Overflow into RG
- Stepping Stone

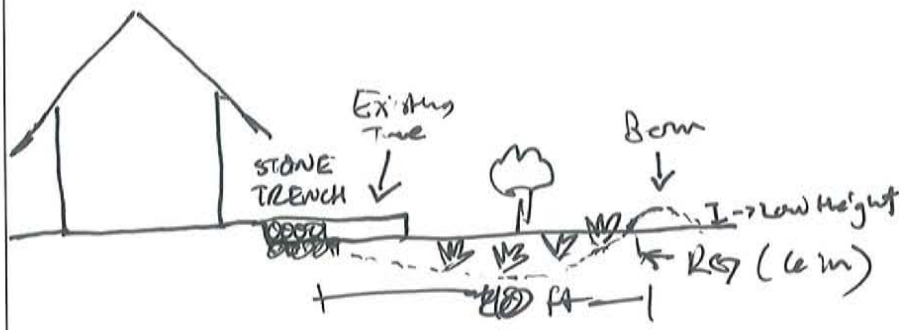
Unique Site ID:_____

SKETCH YOUR PROPOSED RAIN GARDEN *(INCLUDE DIMENSIONS OF AVAILABLE SPACE)*

Planar View:



X- Section



TARGET SURFACE AREA ESTIMATES

Drainage area (impervious) 3300 sf X CNMI target rainfall 0.125 ft / ponding depth .5 ft (e.g.,0.25, 0.50 , 0.67 ft)
= Target rain garden surface area 825 sf

Is space available? ☒ Yes, full ☐ Partial (≥50%) ☐ Partial (<50%)

Unique Site ID:_____

Rain Garden Investigation **RGI**

DATE: 4/26/12	WATERSHED: GES	NAME: STEVE

SITE IDENTIFICATION:

Name/Address: GES

Ownership: ☒ Public ☐ Private ☐ Unknown
If Public, Government Jurisdiction: ☐ Local ☒ State ☐ DOT ☐ Other:_____

WHAT AREA IS BEING TREATED BY YOUR PROPOSED RAIN GARDEN?

☒ Roof ☐ Parking Lot ☐ Walkway/Patio ☐ Other:_____

HOW BIG IS THE DRAINAGE AREA TO BE TREATED? (MEASURE OR PACE OFF)

Length = 150 feet

Width = 22 feet

Area = 3300 square feet

DESCRIBE THE SOIL IN THE AREA PROPOSED FOR THE RAIN GARDEN

☐ Clay ☐ Sand ☐ Loam ☒ Other: LIMESTONE FILL
☐ Compacted ☐ High groundwater (<2 ft)

DESCRIBE THE LOCATION OF YOUR PROPOSED RAIN GARDEN?

Slope: ☒ Area is flat ☐ Area has moderate slope ☐ Area has steep slope

Veg.: ☐ Grassy ☐ Existing trees & shrubs ☐ Existing forest ☐ DNN

Visibility: ☒ High visibility area/lots of people will see it ☐ Some visibility ☐ Low visibility/hidden

Cover: ☒ Sunny ☐ Mixed sun & shade ☐ Shady

Utilities: ☐ Likely ☒ Maybe or nearby ☐ unlikely

Inlet: ☒ Already goes there ☒ Some effort ☐ Will require work ☐ not sure

Outlet: ☐ Easy ☐ Hard ☐ Not sure ☒ NEEDS DEVELOPMENT

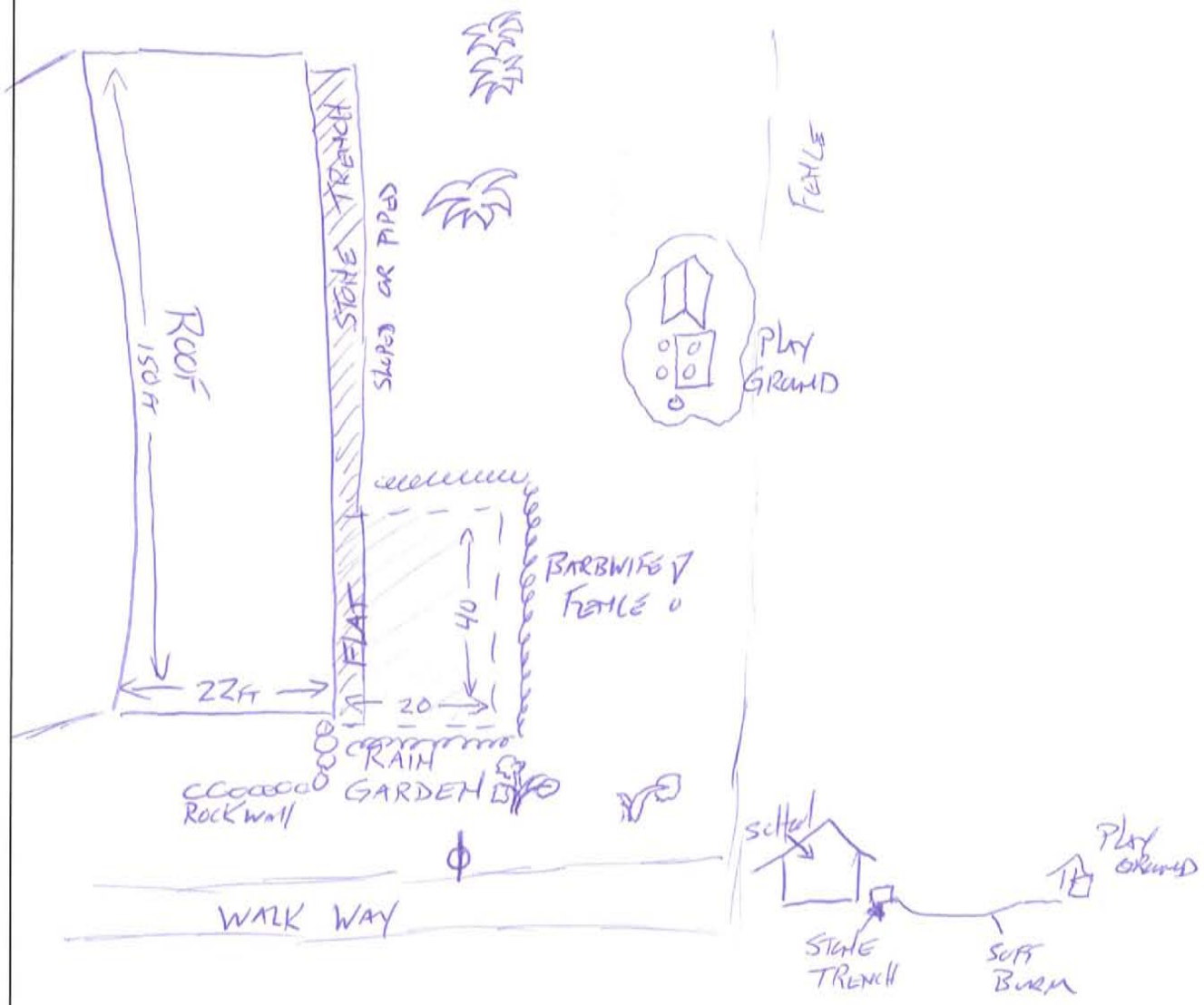
Setbacks: ☐ Met ☐ May be too close ☐ Probably not enough room ☒ No Need
☒ High Foot Traffic

Describe features of your proposed rain garden location:

SIDE TRENCH AT DRIP LINE W/ FLOW INTO GARDEN W/ SOME BARRIER... W/ DEFINED WALK SPACE OR THE LIKE.

Unique Site ID:_____

SKETCH YOUR PROPOSED RAIN GARDEN *(INCLUDE DIMENSIONS OF AVAILABLE SPACE)*



TARGET SURFACE AREA ESTIMATES

Drainage area (impervious) 3300 sf **X** CNMI target rainfall **0.125** ft **/** ponding depth 0.5 ft (e.g.,0.25, 0.50 , 0.67 ft)
= Target rain garden surface area 825 sf

Is space available? ☒ Yes, full ☐ Partial (≥50%) ☐ Partial (<50%)

Unique Site ID:_____

EVALUATION FORM SUMMARY
CNMI Rain Garden Installation Clinic
April 25-26, 2012

N=12

1. Please rate your agreement with the following statements. Circle your response.

1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree, NA = does not apply.

							Avg. Response
I know how to choose a proper site for a rain garden.	1	2	3	4	5	NA	**4.2**
I know how to prepare a rain garden.	1	2	3	4	5	NA	**4.2**
I know how to maintain a rain garden.	1	2	3	4	5	NA	**3.8**
I know how to create a landscape design for a rain garden	1	2	3	4	5	NA	**3.8**
I know the costs involved with installing a rain garden	1	2	3	4	5	NA	**3.3**
I know how to correct standing-water problems in a rain garden.	1	2	3	4	5	NA	**3.9**

2. Please provide your evaluation of the workshop by completing this form. For each category below, please CIRCLE the number that best reflects your evaluation.

	Poor		Good		Excellent	N/A	
Rain Garden Field Installation							
1. Relevance and usefulness	1	2	3	4	5	○	**4.8**
2. Quality of presentation	1	2	3	4	5		**4.5**
Rain Garden Site Selection and Design							
1. Relevance and usefulness	1	2	3	4	5	○	**4.1**
2. Quality of presentation	1	2	3	4	5		**4.2**
Rain Garden Installation & Maintenance							
1. Relevance and usefulness	1	2	3	4	5	○	**4.2**
2. Quality of presentation	1	2	3	4	5		**3.9**
Walking Field Trip to Identify Sites							
1. Relevance and usefulness	1	2	3	4	5	○	**4.4**
2. Quality of presentation	1	2	3	4	5		**4.3**

3. Strengths and Weaknesses:

Which aspects of the workshop did you consider most beneficial?

- Day 2
- The installation of the raingarden at the museum
- constructing the rain garden
- hands-on work
- I learned a lot. Much of the material is useful to me, while a raingarden may not be
- well planned and executed presentation
- hands on approach, get a better idea of whats going on
- the building of the rain garden and the site assessment field trip
- site selection field trip on day 2, classroom on day 1
- visiting the three stations after the lecture

Which aspects of the workshop did you consider least beneficial?

- Missed out on some aspects of installation b/c lots of people so few opps to do all aspects
- for me, a senior, it was a relaxing and enjoyable event. The presenters and staff were well prepared and knew their subject. It made me feel good to know that a much younger generation is doing so well.
- well attended and wide spectrum of participants
- the 1st classroom session after lunch (but it was good!)
- building a garden was useful, but it was difficult to fully participate and learn with so many people and fewer tools and space
- planting might be more useful after learning about rain gardens

4. Did this workshop meet your expectations? O Yes O No **100% Yes**

5. Overall rating of the entire workshop:

Poor		Good		Excellent	**Avg. Response**
1	2	3	4	5	**4.3**

Other comments:

- im sure that b/c of funding, site size was limited, but if it could be bigger so everyone could do differnet things, it would be better
- more discussion of other non-raingarden solutions would be helpful
- thanks gang
- im glad space in the workshop was expanded, but it was difficult on day 1 with so many people. Maybe stagger activities for installation so 1 group does this and others do site scouting? Just an idea. Otherwise it was great!

Evaluation Summary Comments: Installation (from 9 AM-12) ran slightly longer than anticipated and classroom portions was shortened and afternoon field trip added. Slideshows intended for presentation in the afternoon to address some of the details were not shown due to lighting issues. The packet handed out contains much of this information; however, landscape and costs were not included since they were unknowns at the time. To address these issues, we are providing slideshows, cost summaries, and landscape plan to participants via email.